coupled to a line wrapped about the roller 116. Although in the view of Fig. 1, only a single (left) set of idler rollers 9, 25, driven roller 116 and ski 22 are depicted, a substantially identical set (not shown in Fig. 1) will be coupled on the opposite (right) side of the lower frame 23, some of which are shown in Fig. 2.

In the depicted embodiment, resistance to rearward movement 114 of the ski 22 is achieved by coupling the driven roller 116 so as to, in turn, drive a flywheel 17 which can be braked as described more fully below. As depicted in Fig. 2, in one embodiment the driven rollers 116a, 116b are the exterior surfaces of one-way clutches 20a, 20b configured such that when a ski 22a is moved in a rearward direction 114 so as to drive the exterior surface in a first rotational direction 122, the corresponding one-way clutch 20a will engage a driveshaft 31 causing the driveshaft 31 to also rotate in the first direction 122. However, when the ski 22a is moved in the forward direction 112, causing the exterior surface 124 to be moved in an opposite rotational direction 118, the corresponding one-way clutch 20a disengages so that the clutch overrides the driveshaft 31 and is essentially disengaged therefrom. The driveshaft 31 is rotationally mounted in driveshaft bearings 28 and shaft collars 32. A number of one-way clutch devices can be used, including a spring clutch, a plate clutch or a cam clutch. In one embodiment, a clutch of the type used in a Nordic Track™ exercise device (for a different purpose) is used. As seen in Fig. 2, each ski 22a, 22b is coupled to the same type of one-way clutch 20a, 20b, for selectively driving the driveshaft 31. Accordingly, the driveshaft 31 will be driven in a first rotational direction 122 whenever either the left ski 22b or the right ski 22a drives the left driven roller 116a or the driven roller 116b in the rearward rotational direction 122.

In the depicted embodiment, the driveshaft 31 is coupled to a second shaft 35 via V-belt 18, running around sheaves 19, 16. Second shaft 35 is directly coupled to the flywheel 17. Thus, driving the driveshaft 31 results in rotation of the flywheel 17.

Because the flywheel, by virtue of its mass and effective radius (diameter) requires a substantial amount of energy to rotate, the flywheel, creates a certain amount of resistance to rotation of the driven rollers and, thus, the translation of the skis 22a, 22b. Looked at in another way, and without wishing to be bound by any theory, it is believed the flywheel 17 resists the energy generated by the user in moving the skis rearwardly, causing the user's body to thrust forward. In the depicted embodiment, the speed of rotation of the flywheel can be controlled using mechanisms described more thoroughly below.

Preferably, resistance is also provided to rotation of the driven roller 116a, 116b in the opposite (forward) direction 118. Such resistance can be useful in more accurately simulating natural exercise, such as resistance to forward-sliding of cross-country skis through snow. In the depicted embodiment, brake pads 29a, 29b are urged against the inner faces of the one-way clutches 20a, 20b, e.g., by brake springs 30a, 30b. Preferably the brake pad

29 is coupled to the driveshaft 31 so as to rotate therewith. Accordingly, when a ski 22 is moved in the rearward direction 114 and the corresponding one-way clutch 20a is engaged with the driveshaft 31, the brake pad 29a rotates with the inner face 132a of the one-way clutch 20a so that substantially no friction braking of the one-way clutch 20a or driven roller 116a occurs. However, when the ski 22a is moved in the forward direction 112 so that the driven roller 116a is rotated in the forward rotational direction 118 and the one-way clutch is disengaged, the roller 116a and brake pad 29 are rotating in opposite directions 118, 122 respectively so that friction braking of the driven roller 116a occurs, providing frictional resistance to forward motion of the ski 22a.

In the depicted embodiment, a screw adjustment 27 is provided for adjusting the amount of friction (i.e., the pressure) of the brake pads 29a, 29b against the inner faces 132a, 132b of the rollers 116a, 116b. In the depicted embodiment, threaded adjust screws 27 are secured through the lower frame members 23 such that they press against the bearings 28. As the screws 27 are tightened, they force the bearings 28 to press against the clutches 20 which in turn press against the brake pads 29 and compress the springs 30 thereby increasing the intensity of the one-way friction.

Returning to Fig. 1, vertical frame member 7 and upper frame member 3 are preferably provided, extending upward and angularly outward with respect to the lower frame member 23. These frame members 7, 3 position upper arm exercise pulley 2a, 2b at a desired height such that the hand grips 1a, 1b can be grasped by a user for resisted pulling (as described below) to define a line of resistance (from the pulleys 2a, 2b to the user's hands) at a natural and comfortable height. The pulley 2a may be positioned, e.g., approximately at the shoulder height of the user. In one embodiment, the height of the pulley 2a may be adjusted, e.g., by pivoting 144 the upper arm 3. In the depicted embodiment, the hand grip 1a, 1b are coupled to arm exercise lines 4a, 4b running over the upper arm exercise pulleys 2a, 2b, a second arm exercise pulley 5, a third arm exercise pulley 11, such that the opposite ends of the lines engage arm exercise one-way clutch drums 15a, 15b. As shown in Fig. 2, preferably each line 4a, 4b is wound, e.g., in helical fashion around the corresponding drum 15a, 15b. Preferably each drum 15a, 15b is provided with a recoil spring 15c, 15d such that when a user releases or relaxes the grip or tension on a line 4a, 4b, the drum 15a, 15b will rotate in a retract direction 212 to return the lines 4a, 4b to its coiled configuration. Each drum 15a, 15b is coupled to the second shaft 35 via a one-way clutch 214a, 214b. Preferably, the arm exercise one-way clutches 214a, 214b are substantially identical to the leg exercise one-way clutches 20a, 20b. The one-way clutch is configured so that when a line 4a is pulled by a user in a first direction 216, the one-way clutch 214a engages with the second shaft to drive the second shaft 35 in first rotational direction 222. When the line 4a moves in a second, retract direction 212 (under urging of return spring 15c), the one-way clutch 214a disengages from the shaft 35 and overruns the shaft. Thus, in the depicted embodiment, the lines 4a, 4b are coupled to the same resistance mechanism, namely the flywheel 17, as are the skis. The action of the arms and legs independently contribute to the momentum of the flywheel.

Returning to Fig. 1, a friction belt 14 is provided engaging at least a portion (such as about 75%) of the circumference of the flywheel 17. Preferably one end of the friction belt 14 is coupled to a spring 13 while the other end is coupled, via line 134, running over friction band pulley 10 and second friction band pulley 6, to a speed controller clothing clip 8. In one embodiment, an elastic line member such as an elastic "bungee" cord 26 couples the line 134 to the clip 8.

When the clip 8 is coupled to the user, such as by clipping to the user's belt or other clothing, net movement of the user backward 114 on the exercise machine relative to the frame 23 will result in tightening the friction band 14 on the flywheel 17 (in an amount dependent, at least partly, on the spring constant of the spring 13 and/or the effective spring constant of the elastic cord 26), thus slowing the rotation of the flywheel 17. As described above, the flywheel 17 is driven by the movement of the skis 22 and/or hand grips 1a, 1b in a one-way fashion, i.e., such that, in the absence of braking, moving the skis and hand grips faster tends to rotate the flywheel faster.

When the user is in the rearmost position of the machine 136, the friction band is at its tightest around the flywheel, preventing it entirely from spinning. As the user begins exercising and moves forward 112, pressure is released from the friction band and the flywheel begins spinning. Once the user has reached the speed desired by the user (i.e., the level of effort desired by the user), the user continues to exercise at this level and the system will automatically substantially maintain the corresponding speed of the flywheel. If the user slows his or her pace, the user will begin to drift back on the machine 114, under gravity power because of the machine incline 142, resulting in the tightening of the friction band 14 and the slowing of the flywheel speed. As the user speeds up his or her pace, he or she will move forward on the machine 112, decreasing the pressure on the friction band and thereby increasing the flywheel speed. Thus the system provides a method for speed control operated simply by the exerciser increasing or decreasing his or her level of effort. Thus there is no requirement for manual adjustments in order to change the intensity of the workout.

In practice, the user will mount the device, inserting his or her feet into the foot support 21 of the skis 22 and grasping the hand grips 1. The user will attach the clothing clip 8 to his or her clothing. Initially the user will be near the rear-most position 136 and the friction band 14 will be at its tightest. The user will move the skis in reciprocating fashion with a normal skiing motion and, because of the resistance mechanisms described above, the user will begin to move up 112 the incline 142 toward the front of the machine 138 and will cause the flywheel to begin rotating. Once the flywheel begins to spin, as the user's position fore and aft on the machine changes, there will be resultant constant variations in the machine friction band tension on the flywheel. As the user slows, the momentum of the flywheel will tend to propel him or her backward. However, as the user moves back, the friction band is tightened, as described above, and thus the flywheel begins to slow down until a balance is attained. As the